

WHAT IS CLAIMED IS:

- 5 Sub B3
- (a) A two-part adhesive system, comprising:
an adhesive part A, which comprises:
a monomer selected from the group consisting of a monofunctional acrylate monomer, a difunctional acrylate monomer, a trifunctional acrylate monomer, a monofunctional methacrylate monomer, a difunctional methacrylate monomer, a trifunctional methacrylate monomer, or a combination thereof;
a peroxide or hydroperoxide free-radical initiator; and
an antioxidant;
- 10 (b) an activator part B, which comprises:
a N,N-disubstituted aromatic amine,
a difunctional methacrylate monomer,
an antioxidant.

15

2. The system of claim 1 further comprising ~~and~~ a thickener, a thixotrope, an adhesion promoter, or combination thereof.

20 Sub B4

- 3/26/03
- The system of claim 1 wherein for Part A the monomer is selected from the group consisting of methyl methacrylate, methacrylic acid, isobornyl methacrylate, ethylene glycol dimethacrylate, ethoxylated bisphenol A diacrylate esters, tetraethylene glycol dimethacrylate, diethylene glycol dimethacrylate, diethylene glycol diacrylate, tris (2-hydroxyethyl) isocyanurate triacrylate, an alkyl ester of acrylic acid, a hydroxy alkyl ester of acrylic acid, an alkyl ester of methacrylic acid, a hydroxy alkyl ester of methacrylic acid, butyleneglycol dimethacrylate, tetraethyleneglycol dimethacrylate, polyethylene glycol dimethacrylate, bisphenol A dimethacrylate, ethoxylated bisphenol A dimethacrylate, pentaerythritol dimethacrylate, butyleneglycol trimethacrylate, tetraethyleneglycol trimethacrylate, polyethylene glycol trimethacrylate, bisphenol A trimethacrylate, ethoxylated bisphenol A trimethacrylate, and pentaerythritol trimethacrylate.

Sub B4
cont.

4. The system of claim 1 wherein for Part B the difunctional methacrylate monomer is present in an amount of from about 10 to about 80 percent based on weight, and wherein any other monomers present are in amounts ranging from about 5 to about 30 percent based on weight of the total formulation.

5. The system of claim 1 wherein the free-radical initiator is benzoyl peroxide (BPO), cumene hydroperoxide, or a combination thereof.

6. The system of claim 1 further comprising fused silica in Part A.

7. The system of claim 1 further comprising in Part A an acrylated polyester oligomers, gamma-methacryloxypropyltrimethoxysilane, or tris-(ω -methoxyethoxy)silane.

8. The system of claim 1 wherein the antioxidant is hydroquinone, benzoquinone, or a combination thereof.

9. The system of claim 1 wherein in Part B the difunctional methacrylate monomer is ethylene glycol dimethacrylate or propylene glycol dimethacrylate.

10. The system of claim 1 wherein in Part A the monomer is ethylene glycol dimethacrylate or propylene glycol dimethacrylate.

11. The system of claim 1 wherein in Part B the difunctional methacrylate monomer is present in an amount of from about 80 percent to about 99 percent.

12. The system of claim 1 wherein in Part B the N,N-disubstituted aromatic amine is N,N-dimethyl-p-toluidine, N,N-dimethylaniline, N,N-diethylaniline, or 4,4'-methylenebis (N,N-dimethylaniline).

13. The system of claim 1 wherein the N,N-disubstituted aromatic amine is present in an amount of from about 0.5 to about 5.0 percent by weight of Part B.

5 ⁵¹⁵ 14. The system of claim 1 wherein the amounts of parts A and B are at a volume ratio of part A to part B of about 1:1.

Sub B5 15. The reaction product formed from a two-part adhesive system comprised of a part A and a part B, wherein the part A and part B comprise:

10 (a) an adhesive part A, which comprises:
a monomer selected from the group consisting of a monofunctional acrylate monomer, a difunctional acrylate monomer, a trifunctional acrylate monomer, a monofunctional methacrylate monomer, a difunctional methacrylate monomer, a trifunctional methacrylate monomer, or a combination thereof;

15 a peroxide or hydroperoxide free-radical initiator; and
an antioxidant;

(b) an activator part B, which comprises:
a N,N-disubstituted aromatic amine,
a difunctional methacrylate monomer,
an antioxidant.

20 16. A primer-based adhesive system, comprising:

(a) an adhesive part A, which comprises:
one or more monofunctional, difunctional, or trifunctional acrylate or methacrylate monomers,

25 a peroxide or hydroperoxide free-radical initiator,
an antioxidant, and

(b) a primer part B, which comprises:
a N,N-disubstituted aromatic amine,
an adhesion promoter, and

a solvent.

17. A reaction product formed from part A and part B.

5 18. The system of claim 16 further comprising a thickener, a thixotrope, an adhesion promoter, or combination thereof.

19. The system of claim 16 wherein for Part A the monomer is selected from the group consisting of methyl methacrylate, methacrylic acid, isobornyl methacrylate, ethylene glycol dimethacrylate, ethoxylated bisphenol A diacrylate esters, tetraethylene glycol dimethacrylate, diethylene glycol dimethacrylate, diethylene glycol diacrylate, tris (2-hydroxyethyl) isocyanurate triacrylate, an alkyl ester of acrylic acid, a hydroxy alkyl ester of acrylic acid, an alkyl ester of methacrylic acid, a hydroxy alkyl ester of methacrylic acid, butyleneglycol dimethacrylate, tetraethyleneglycol dimethacrylate, polyethylene glycol dimethacrylate, bisphenol A dimethacrylate, ethoxylated bisphenol A dimethacrylate, pentaerythritol dimethacrylate, butyleneglycol trimethacrylate, tetraethyleneglycol trimethacrylate, polyethylene glycol trimethacrylate, bisphenol A trimethacrylate, ethoxylated bisphenol A trimethacrylate, and pentaerythritol trimethacrylate.

20 20. The system of claim 16 wherein for Part B the N,N-disubstituted aromatic amine is present in an amount of from about 0.5 to about 3 percent.

21. The system of claim 16 wherein the free-radical initiator is benzoyl peroxide (BPO), cumene hydroperoxide, or a combination thereof.

25

22. The system of claim 16 further comprising fused silica in Part A.

23. The system of claim 16 wherein the solvent is a ketone, a hydrocarbon, an ester, an alcohol, or combination thereof.

24. A primer-based adhesive composition, comprising:

(a) an adhesive part A, which comprises:

one or more monofunctional, difunctional, or trifunctional acrylate or

5 methacrylate monomers,

a N,N-disubstituted aromatic amine, and

an antioxidant, and

(b) a primer part B, which comprises:

a peroxide or hydroperoxide free-radical initiator, and

10 a solvent.

25. The composition of claim 24 further comprising in part A, part B, or both part A and part B a thickener, a thixotrope, an adhesion promoter, or combination thereof.

15 26. The composition of claim 24 wherein for Part A the monomer is selected from the group consisting of methyl methacrylate, methacrylic acid, isobornyl methacrylate, ethylene glycol dimethacrylate, ethoxylated bisphenol A diacrylate esters, tetraethylene glycol dimethacrylate, diethylene glycol dimethacrylate, diethylene glycol diacrylate, tris (2-hydroxyethyl) isocyanurate triacrylate, an alkyl ester of acrylic acid, a hydroxy alkyl ester of acrylic acid, an alkyl ester of methacrylic acid, a hydroxy alkyl ester of methacrylic acid, 20 butyleneglycol dimethacrylate, tetraethyleneglycol dimethacrylate, polyethylene glycol dimethacrylate, bisphenol A dimethacrylate, ethoxylated bisphenol A dimethacrylate, pentaerythritol dimethacrylate, butyleneglycol trimethacrylate, tetraethyleneglycol trimethacrylate, polyethylene glycol trimethacrylate, bisphenol A trimethacrylate, ethoxylated 25 bisphenol A trimethacrylate, and pentaerythritol trimethacrylate.

27. The composition of claim 24 wherein for Part A the N,N-disubstituted aromatic amine is present in an amount of from about 0.5 to about 3 percent.

28. The composition of claim 24 wherein the free-radical initiator is benzoyl peroxide (BPO), cumene hydroperoxide, or a combination thereof.

29. The composition of claim 24 further comprising fused silica in Part A.

30. The composition of claim 24 wherein the solvent is a ketone, a hydrocarbon, an ester, an alcohol, or combination thereof.

31. A reaction product of part A and part B of claim 24.

32. A process useful for adhering one surface to a second surface, which comprises:

applying a primer part B to the first surface, wherein the primer part B comprises a N,N-disubstituted aromatic amine, an adhesion promoter, and a solvent,

allowing the solvent to evaporate so that the activator is on the first surface,

applying a part A to the primed surface, wherein the part A comprises one or more monofunctional, difunctional, or trifunctional acrylate or methacrylate monomers, a peroxy initiator, and an antioxidant,

pressing the first surface to the second surface so that the part A and part B are in contact and sandwiched between the two surfaces until the part A and part B have cured.

33. The process of claim 32 wherein the part A further comprises a thickener, a thixotrope, an adhesion promoter, or combination thereof.

34. The process of claim 32 wherein for Part A the monomer is selected from the group consisting of methyl methacrylate, methacrylic acid, isobornyl methacrylate, ethylene glycol dimethacrylate, ethoxylated bisphenol A diacrylate esters, tetraethylene glycol dimethacrylate, diethylene glycol dimethacrylate, diethylene glycol diacrylate, tris (2-hydroxyethyl) isocyanurate triacrylate, an alkyl ester of acrylic acid, a hydroxy alkyl ester of

acrylic acid, an alkyl ester of methacrylic acid, a hydroxy alkyl ester of methacrylic acid, butyleneglycol dimethacrylate, tetraethyleneglycol dimethacrylate, polyethylene glycol dimethacrylate, bisphenol A dimethacrylate, ethoxylated bisphenol A dimethacrylate, pentaerythritol dimethacrylate, butyleneglycol trimethacrylate, tetraethyleneglycol trimethacrylate, polyethylene glycol trimethacrylate, bisphenol A trimethacrylate, ethoxylated bisphenol A trimethacrylate, and pentaerythritol trimethacrylate.

35. The process of claim 32 wherein for Part B the N,N-disubstituted aromatic amine is present in an amount of from about 0.5 to about 3 percent.

36. The process of claim 32 wherein the free-radical initiator is benzoyl peroxide (BPO), cumene hydroperoxide, or a combination thereof.

37. The process of claim 32 further comprising fused silica in Part A.

38. The process of claim 32 wherein the solvent is a ketone, a hydrocarbon, an ester, an alcohol, or combination thereof.

39. A process useful for adhering a first surface to a second surface which comprises:

mixing a part A and a part B to form an admixture, wherein the part A, which comprises:

a monomer selected from the group consisting of a monofunctional acrylate monomer, a difunctional acrylate monomer, a trifunctional acrylate monomer, a monofunctional methacrylate monomer, a difunctional methacrylate monomer, a trifunctional methacrylate monomer, or a combination thereof;

a peroxide or hydroperoxide free-radical initiator; and

an antioxidant; and wherein the part B comprises:

an activator part B, which comprises:

a N,N-disubstituted aromatic amine.
a difunctional methacrylate monomer.
an antioxidant,

applying the admixture to a first surface,

5 pressing the second surface and the first surface together so that the admixture is
between the two surfaces for a time sufficient to effect curing of the admixture.

40. The process of claim 39 further comprising and a thickener, a thixotrope, an
adhesion promoter, or combination thereof.

10 41. The process of claim 39 wherein for Part A the monomer is selected from the
group consisting of methyl methacrylate, methacrylic acid, isobornyl methacrylate, ethylene
glycol dimethacrylate, ethoxylated bisphenol A diacrylate esters, tetraethylene glycol
dimethacrylate, diethylene glycol dimethacrylate, diethylene glycol diacrylate, tris (2-
15 hydroxyethyl) isocyanurate triacrylate, an alkyl ester of acrylic acid, a hydroxy alkyl ester of
acrylic acid, an alkyl ester of methacrylic acid, a hydroxy alkyl ester of methacrylic acid,
butyleneglycol dimethacrylate, tetraethyleneglycol dimethacrylate, polyethylene glycol
dimethacrylate, bisphenol A dimethacrylate, ethoxylated bisphenol A dimethacrylate,
pentaerythritol dimethacrylate, butyleneglycol trimethacrylate, tetraethyleneglycol
20 trimethacrylate, polyethylene glycol trimethacrylate, bisphenol A trimethacrylate, ethoxylated
bisphenol A trimethacrylate, and pentaerythritol trimethacrylate.

42. The process of claim 39 wherein for Part B the difunctional methacrylate
monomer is present in an amount of from about 10 to about 80 percent based on weight, and
25 wherein any other monomers present are in amounts ranging from about 5 to about 30 percent
based on weight of the total formulation.

43. The process of claim 39 wherein the free-radical initiator is benzoyl peroxide
(BPO), cumene hydroperoxide, or a combination thereof.

44. The process of claim 39 further comprising fused silica in Part A.

45. The process of claim 39 further comprising in Part A an acrylated polyester
5 oligomers, gamma-methacryloxypropyltrimethoxysilane, or tris-(ω -methoxyethoxy)silane.

46. The process of claim 39 wherein the antioxidant is hydroquinone,
benzoquinone, or a combination thereof.

10 47. The process of claim 39 wherein in Part B the alkylene glycol dimethacrylate is
ethylene glycol dimethacrylate or propylene glycol dimethacrylate.

48. The process of claim 39 wherein in Part A the monomer is ethylene glycol
dimethacrylate or propylene glycol dimethacrylate.

15 49. The process of claim 39 wherein in Part B the difunctional methacrylate
monomer is present in an amount of from about 80 percent to about 99 percent.

20 50. The process of claim 39 wherein in Part B the N,N-disubstituted aromatic
amine is N,N-dimethyl-p-toluidine, N,N-dimethylaniline, N,N-diethylaniline, or 4,4'-
methylenebis (N,N-dimethylaniline).

51. The process of claim 39 wherein the N,N-disubstituted aromatic amine is
present in an amount of from about 0.5 to about 5.0 percent by weight of Part B.

25 52. The process of claim 39 wherein the amounts of parts A and B are at a volume
ratio of part A to part B of about 1:1.

53. A process useful for setting an optical fiber within an optical fiber connector that includes a ferrule for insertion of the optical fiber, comprising:

mixing a part A and a part B to form an admixture, wherein the part A, which comprises:

5 a monomer selected from the group consisting of a monofunctional acrylate monomer, a difunctional acrylate monomer, a trifunctional acrylate monomer, a monofunctional methacrylate monomer, a difunctional methacrylate monomer, a trifunctional methacrylate monomer, or a combination thereof;

a peroxide or hydroperoxide free-radical initiator; and

10 an antioxidant; and wherein the part B comprises:

an activator part B, which comprises:

a N,N-disubstituted aromatic amine,

a difunctional methacrylate monomer,

an antioxidant,

15 injecting the admixture into the ferrule of a connector,

inserting an optical fiber into the ferrule, and

allowing the admixture to cure to thereby set the fiber in place within the connector.

54. The process of claim 53 further comprising in part A, part B, or both part A
20 and part B, a thickener, a thixotrope, an adhesion promoter, or combination thereof.

55. The process of claim 53 wherein for Part A the monomer is selected from the group consisting of methyl methacrylate, methacrylic acid, isobornyl methacrylate, ethylene glycol dimethacrylate, ethoxylated bisphenol A diacrylate esters, tetraethylene glycol
25 dimethacrylate, diethylene glycol dimethacrylate, diethylene glycol diacrylate, tris (2-hydroxyethyl) isocyanurate triacrylate, an alkyl ester of acrylic acid, a hydroxy alkyl ester of acrylic acid, an alkyl ester of methacrylic acid, a hydroxy alkyl ester of methacrylic acid, butyleneglycol dimethacrylate, tetraethyleneglycol dimethacrylate, polyethylene glycol dimethacrylate, bisphenol A dimethacrylate, ethoxylated bisphenol A dimethacrylate,

pentaerythritol dimethacrylate, butyleneglycol trimethacrylate, tetraethyleneglycol trimethacrylate, polyethylene glycol trimethacrylate, bisphenol A trimethacrylate, ethoxylated bisphenol A trimethacrylate, and pentaerythritol trimethacrylate.

5 56. The process of claim 53 wherein for Part B the difunctional methacrylate monomer is present in an amount of from about 10 to about 80 percent based on weight, and wherein any other monomers present are in amounts ranging from about 5 to about 30 percent based on weight of the total formulation.

10 57. The process of claim 53 wherein the free-radical initiator is benzoyl peroxide (BPO), cumene hydroperoxide, or a combination thereof.

58. The process of claim 53 further comprising fused silica in Part A.

15 59. The process of claim 53 further comprising in Part A an acrylated polyester oligomers, gamma-methacryloxypropyltrimethoxysilane, or tris-(ω -methoxyethoxy)silane.

60. The process of claim 53 wherein the antioxidant is hydroquinone, benzoquinone, or a combination thereof.

20 61. The process of claim 39 wherein in Part B the difunctional methacrylate monomer is ethylene glycol dimethacrylate or propylene glycol dimethacrylate.

62. The process of claim 53 wherein in Part A the monomer is ethylene glycol dimethacrylate or propylene glycol dimethacrylate.

25 63. The process of claim 53 wherein in Part B the alkylene glycol dimethylacrylate is present in an amount of from about 10 percent to about 80 percent.

64. The process of claim 53 wherein in Part B the N,N-disubstituted aromatic amine is N,N-dimethyl-p-toluidine, N,N-dimethylaniline, N,N-diethylaniline, or 4,4'-methylenebis (N,N-dimethylaniline).

5 65. The process of claim 53 wherein the N,N-disubstituted aromatic amine is present in an amount of from about 0.5 to about 5.0 percent by weight of Part B.

66. The process of claim 53 wherein the amounts of parts A and B are at a volume ratio of part A to part B of about 1:1.

10 67. A process useful for setting an optical fiber within an optical fiber connector that includes a ferrule for insertion of the optical fiber, comprising:

applying a part B primer to the fiber, wherein the primer part B comprises a N,N-disubstituted aromatic amine, an adhesion promoter, and a solvent,

15 allowing the solvent to evaporate, and

subsequently injecting a part A adhesive into the ferrule, wherein the part A comprises one or more monofunctional, difunctional, or trifunctional acrylate or methacrylate monomers, a peroxy initiator, and an antioxidant,

followed by inserting the primed optical fiber into the ferrule, and

20 allowing the part A and part B to cure to thereby set the fiber in place within the connector.

68. The process of claim 67 wherein the part A further comprises a thickener, a thixotrope, an adhesion promoter, or combination thereof.

25 69. The process of claim 67 wherein for Part A the monomer is selected from the group consisting of methyl methacrylate, methacrylic acid, isobornyl methacrylate, ethylene glycol dimethacrylate, ethoxylated bisphenol A diacrylate esters, tetraethylene glycol dimethacrylate, diethylene glycol dimethacrylate, diethylene glycol diacrylate, tris (2-

hydroxyethyl) isocyanurate triacrylate, an alkyl ester of acrylic acid, a hydroxy alkyl ester of acrylic acid, an alkyl ester of methacrylic acid, a hydroxy alkyl ester of methacrylic acid, butyleneglycol dimethacrylate, tetraethyleneglycol dimethacrylate, polyethylene glycol dimethacrylate, bisphenol A dimethacrylate, ethoxylated bisphenol A dimethacrylate, 5 pentaerythritol dimethacrylate, butyleneglycol trimethacrylate, tetraethyleneglycol trimethacrylate, polyethylene glycol trimethacrylate, bisphenol A trimethacrylate, ethoxylated bisphenol A trimethacrylate, and pentaerythritol trimethacrylate.

70. The process of claim 67 wherein for Part B the N,N-disubstituted aromatic
10 amine is present in an amount of from about 0.5 to about 3 percent.

71. The process of claim 67 wherein the free-radical initiator is benzoyl peroxide
(BPO), cumene hydroperoxide, or a combination thereof.

15 72. The process of claim 67 further comprising fused silica in Part A.

73. The process of claim 67 wherein the solvent is a ketone, a hydrocarbon, an
ester, an alcohol, or combination thereof.

20 74. A process useful for adhering one surface to a second surface, which
comprises:

applying a primer part B to the first surface, wherein the primer part B comprises a
primer part B, which comprises: a peroxide or hydroperoxide free-radical initiator, and
a solvent,

25 allowing the solvent to evaporate so that the activator is on the first surface,

applying a part A to the primed surface, wherein the part A comprises one or more
monofunctional, difunctional, or trifunctional acrylate or methacrylate monomers, a N,N-
disubstituted aromatic amine, and an antioxidant,

pressing the first surface to the second surface so that the part A and part B are in contact and sandwiched between the two surfaces until the part A and part B have cured.

75. The process of claim 74 wherein the part A further comprises a thickener, a
5 thixotrope, an adhesion promoter, or combination thereof.

76. The process of claim 74 wherein for Part A the monomer is selected from the
group consisting of methyl methacrylate, methacrylic acid, isobornyl methacrylate, ethylene
glycol dimethacrylate, ethoxylated bisphenol A diacrylate esters, tetraethylene glycol
10 dimethacrylate, diethylene glycol dimethacrylate, diethylene glycol diacrylate, tris (2-
hydroxyethyl) isocyanurate triacrylate, an alkyl ester of acrylic acid, a hydroxy alkyl ester of
acrylic acid, an alkyl ester of methacrylic acid, a hydroxy alkyl ester of methacrylic acid,
butyleneglycol dimethacrylate, tetraethyleneglycol dimethacrylate, polyethylene glycol
dimethacrylate, bisphenol A dimethacrylate, ethoxylated bisphenol A dimethacrylate,
15 pentaerythritol dimethacrylate, butyleneglycol trimethacrylate, tetraethyleneglycol
trimethacrylate, polyethylene glycol trimethacrylate, bisphenol A trimethacrylate, ethoxylated
bisphenol A trimethacrylate, and pentaerythritol trimethacrylate.

77. The process of claim 74 wherein for Part A the N,N-disubstituted aromatic
20 amine is present in an amount of from about 0.5 to about 3 percent.

78. The process of claim 74 wherein the free-radical initiator is benzoyl peroxide
(BPO), cumene hydroperoxide, or a combination thereof.

79. The process of claim 74 further comprising fused silica in Part A.
25

80. The process of claim 74 wherein the solvent is a ketone, a hydrocarbon, an
ester, an alcohol, or combination thereof.

81. A process useful for setting an optical fiber within an optical fiber connector that includes a ferrule for insertion of the optical fiber, comprising:

applying a part B primer to the fiber, wherein the primer part B comprises a peroxide or hydroperoxide free-radical initiator, and a solvent,

5 allowing the solvent to evaporate, and

subsequently injecting a part A adhesive into the ferrule, wherein the part A comprises one or more monofunctional, difunctional, or trifunctional acrylate or methacrylate monomers, a N,N-disubstituted aromatic amine, and an antioxidant,

followed by inserting the primed optical fiber into the ferrule, and

10 allowing the part A and part B to cure to thereby set the fiber in place within the connector.

82. The process of claim 81 wherein the part A further comprises a thickener, a thixotrope, an adhesion promoter, or combination thereof.

15 83. The process of claim 81 wherein for the monomer is selected from the group consisting of methyl methacrylate, methacrylic acid, isobornyl methacrylate, ethylene glycol dimethacrylate, ethoxylated bisphenol A diacrylate esters, tetraethylene glycol dimethacrylate, diethylene glycol dimethacrylate, diethylene glycol diacrylate, tris (2-hydroxyethyl)
20 isocyanurate triacrylate, an alkyl ester of acrylic acid, a hydroxy alkyl ester of acrylic acid, an alkyl ester of methacrylic acid, a hydroxy alkyl ester of methacrylic acid, butyleneglycol dimethacrylate, tetraethyleneglycol dimethacrylate, polyethylene glycol dimethacrylate, bisphenol A dimethacrylate, ethoxylated bisphenol A dimethacrylate, pentaerythritol dimethacrylate, butyleneglycol trimethacrylate, tetraethyleneglycol trimethacrylate,
25 polyethylene glycol trimethacrylate, bisphenol A trimethacrylate, ethoxylated bisphenol A trimethacrylate, and pentaerythritol trimethacrylate.

84. The process of claim 81 wherein for part A the N,N-disubstituted aromatic amine is present in an amount of from about 0.5 to about 3 percent.

85. The process of claim 81 wherein the free-radical initiator is benzoyl peroxide (BPO), cumene hydroperoxide, or a combination thereof.

5 86. The process of claim 81 further comprising fused silica in Part A.

87. The process of claim 81 wherein the solvent is a ketone, a hydrocarbon, an ester, an alcohol, or combination thereof.

10

Add B2

15